THE RESPONSE OF MYSID SHRIMPS TO PHYTOPLANKTON DISTRIBUTION IN A HIGH ENERGY SURFZONE

Visible accumulations of the diatom, *Anaulus australis*, are characteristic of the surfzone along the Sundays River beach, South Africa. Generally the beach is characterised by active rip systems separated by welded bars. Diatom accumulations are relatively close inshore adjacent to rips and these occur at a frequency of 2 per running kilometre of beach (Talbot and Bate, 1987). At the breakpoint 250–300 m from the swashline, wave height ranges from 1–6 m. Median particle size of beach sand is c. 260 µm. Tides are semi-diurnal, subequal; with a maximum spring tide range of 2.1 m. Water temperatures range from 15–24° C.

Despite this physically harsh environment, two species of mysids are commonly encountered. In the breaker-zone, the bentho-planktonic *Gastrosaccus psammodytes* occurs in numbers of up to 200 m^{-2}. Behind the breakers, the gregarious *Mesopodopsis slabberi* has been recorded in numbers of up to 15,000 m^{-3}.

During the day, *Gastrosaccus psammodytes* is confined to the white-water zone where it exhibits a well defined pattern of intra-specific zonation. Brooding females are significantly more abundant within 10–20 m of the swashline, while males and immatures become progressively more abundant further distant from the beach. Advantages which accrue to brooding females are mostly linked to less frequent disturbance from the substrate as a result of reduced wave turbulence. Inter-alia, physical loss of larvae from the brood pouch is reduced. *Gastrosaccus psammodytes* is a tidal migrant and the pattern of intra-specific zonation is maintained over the tidal cycle.

Close inshore, mysids utilise a rich, but localised phytoplankton food source. Diurnally, alongshore abundance of adult mysids was significantly greater in areas of phytoplankton accumulations (adjacent to rips) on four of five occasions when patches were visible (Chlorophyll-a concentration > 40–100 mg m^{-3} (Campbell, 1988)). On all occasions, adults were dominated by brooding females. Water currents must play a role in dictating mysid distribution, but under relatively calm surf conditions, the distribution of adults is interpreted as a response to the food concentration gradient. This allows maximisation of food intake as mysids (particularly brooding females) undergo forays into the water column. As the energy state of the surfzone increases, water currents feeding into rips must play a progressively more important role in determining mysid distribution. Alongshore distribution of immature mysids is often different to the adult pattern. Since swimming ability of juveniles is weaker compared to adults, threshold water velocities would be less with respect to the influence currents exert on dispersion patterns. Although adults may respond to a food concentration gradient, prevailing current velocities may be sufficient to act as the main forcing function in determining distribution of immature mysids relative to the rips (Wooldridge, 1989).

Although *Anaulus australis* accumulations are generally closely associated with rip currents, cells are continually being added to and eroded from patches as a result of water currents. Cells eroded from patches may be entrained in rips and transported seawards. In the cases of major rip activity, phytoplankton may also be transported behind the breaker line. Here, the lack of air-bubble formation (cell buoyancy is due to attachment to air bubbles) results in the sinking of cells which then accumulate near the bottom of the water column. Re-entry into the breaker zone will occur if wave energy increases, which effectively stirs up the bottom and advects cells shorewards as waves begin to break further offshore (Talbot and Bate, 1988).

Anaulus australis also exhibits a well defined pattern of temporal variability. In the late afternoon, cells become psammophyllic, adhering to sand grains as a result of anatomical changes at the surface of the cell's frustule (Talbot and Bate, 1928). Consequently, *Anaulus* disappears from the water column and is not available to mysids foraging close inshore after dark.

The non-availability at night of phytoplankton in the inner surfzone results in a concomitant change in the feeding behaviour of *Gastrosaccus psammodytes*. The brooding component of the population remains inshore where they become more carnivorous, feeding in the shallows on planktonic and benthic organisms. The more pelagic component of the mysid population migrates offshore where they exploit the accumulated food source behind the breakers. They remain planktonic for the remainder of the night, returning to their inshore habitat at dawn.

A second species of mysid, *Mesopodopsis slabberi* also utilises the accumulated food source behind the breakers at night. Since it is a pelagic species, it seldom ventures into the white-water zone where it would be vulnerable to the more turbulent conditions experienced there. *Anaulus australis* is therefore not available as a food source during the day. Instead, *M. slabberi* remains in deeper water during daylight where it is less visible to predators feeding in the water column. Off Sundays River beach, swarms of this species are encountered at about 15 m depth where they remain in close proximity to reefs. After dark, there is a general migration onshore where they remain until dawn feeding behind the breakers (Webb and Wooldridge, 1990).

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